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## Concept and Methodological Aspects of Providing Balanced Innovative Development of Transportation System of the Russian Federation

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**Abstract.** The growth of significance for innovative economic development of the Russian Federation determines necessity of deeper investigation of properties and specific features of its subsystems functioning, content and forms of their interaction, search for increasing efficiency of control systems. The transportation system is the most important strategic link of social and economic development of the country, one of the most dynamic, multiplicative and promising segments of the market, which makes 12.5 % of the gross domestic product (GDP) of the Russian Federation. An analysis of transport activity has demonstrated a smoldering recession over the last years which is accompanied by reduction of values for the most important resulting indicators. Strategic benchmarks of developing transportation activity are objectified by the consumers' demands not only in safe, but in comfortable life medium with high environmental characteristics and aesthetic requirements. The satisfaction of such requirements is possible under condition of large-scale modernization of transportation sphere with the use of breakthrough scientific and technical solutions in all segments of human activity. All this can afford ground that it is necessary to change fundamentally an approach to investigating properties, peculiarities and factors of the transportation system development that provokes modernization of the control system for providing a balanced innovative trend and high standards of population life quality. The results of the investigations have shown that important factors of transportation system development are the following: fair competition, freedom of economic activity, development of market mechanisms, corporate culture and moral values. Study of functioning and scientific approaches to balancing innovative development of the transportation system of the Russian Federation has made it possible to create a conceptual vision and methodological basis with due account of main principles of systems theory, self-organization and synergetics and present it in brief in the given paper.

**Keywords:** transport system, innovative development, economic system, management, organizational and managerial innovations, balanced development, management system, efficiency, quality

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## Концепт и методологические аспекты обеспечения сбалансированного инновационного развития транспортной системы Российской Федерации

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**Реферат.** Возрастание значимости инновационного развития экономики Российской Федерации обуславливает необходимость более глубокого исследования свойств и особенностей функционирования ее подсистем, содержания и форм их взаимодействия, поиска путей повышения эффективности систем управления. Транспортная система –

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важнейшее стратегическое звено социально-экономического развития страны, один из самых динамичных, мультипликативных и перспективных сегментов рынка, на который приходится 12,5 % ВВП Российской Федерации. Анализ транспортной деятельности показал вялотекущую рецессию в последние годы, сопровождающуюся снижением значений важнейших результирующих показателей. Стратегические ориентиры развития транспортной деятельности объектируются запросами потребителей не только в безопасной, но и в комфортной среде жизни с высокими экологическими характеристиками и эстетическими требованиями. Удовлетворение таких требований возможно при условии масштабной модернизации транспортной сферы с применением прорывных научно-технических решений во всех сегментах человеческой деятельности. Все это дает основание для заключения о том, что необходимо принципиальное изменение подхода к исследованию свойств, особенностей и факторов развития транспортной системы, что провоцирует модернизацию системы управления для обеспечения сбалансированного инновационного тренда и высоких стандартов качества жизни населения. Результаты исследования показывают, что важными факторами развития транспортной системы являются добросовестная конкуренция, свобода экономической деятельности, развитие рыночных механизмов, корпоративной культуры и нравственных ценностей. Изучение функционирования и научных подходов к обеспечению сбалансированного инновационного развития транспортной системы Российской Федерации позволило сформировать концептуальное видение и методологический базис с учетом основных положений теорий систем, самоорганизации и синергетики и кратко представить в данной работе.

**Ключевые слова:** транспортная система, инновационное развитие, экономическая система, управление, организационно-управленческие инновации, сбалансированное развитие, система менеджмента, эффективность, качество

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## Introduction

The stability and balanced state of the social and economic development are determined by the methods of combining forms and methods of organizational influence in the management system, character of interaction of social and economic institutions, axiological perceptions and patterns of business entity behavior, economical interests and needs of the society. Time is a significant characteristic of trend of developing social and economic systems, since they are characterized by high response rate, uncertainty and hysteresis processes, which objectifies a necessity of regulated synchronous and multi-positional control. In this case the directional selectivity of organizational changes depends on the particular characteristics of economic activity, geography, economic security, legal environment, public relations, climate and other exo- and endogenous variables.

The present-day stage of academic pursuits relies on a high level of detail of social and economic systems, investigation of processes of self-regulation and self-organization as well as factors determining the character and direction of the development trend. In this regard, this work is focused on identification of control parameters and mechanisms proving fairness of the conceptual approach to provide stability of the most important subsystem of national economy; building variations of models of its balanced innovative development

capable of expanding the instrumental base of investigations and provide high efficiency of the control system.

## Main part

The transportation system (TS) corresponds to a combination of business entities, means of transportation and infrastructure providing functionality of all types of transportation and coherent system development with the aim of satisfying public needs and efficient development. Annually, 45 bln people are transported by all means of transportation in the country, while the annual volume of dispatching cargo exceeds 10 bln t. The transport share in GDP of the RF equals 12.5 %, while the number of people engaged in this sphere exceeds 7 %. In order to shape a concept of the balanced innovative development of the most important subsystem of national economy, we will consider transportation system from the positions of the theories of systems, dissipative structures and synergetics [1–4].

The system and synergetic thinking implies speculations about: intricacy of world order; responsibility and ambiguity of results of managerial solutions; modeling and relative unpredictability of innovative system development; problems of choice. An initial prerequisite for the balanced control consists in preserving resilience of a system and attaining a desirable state, whereupon the

control systems shall be focused irrespective of organizational level thereof [5–10].

The investigation of economic position, trends of the TS development and environment undergoing system transformations, gives rise to the imminence of dynamics in the system of organization and a new level of requirements, approaches to the TS control. Let us place emphasis on the key factors of economy and society, keeping modernization of the existing TS control system up to date: scientific and technical progress and shaping intellectual and creative, innovative type of economy; globalization as an impersonal process of building a unified world system of management and public relations; limited and degraded nature of resources, sensitizing to a necessity of transition to the energy- and resource-efficient processes and technologies (sustainable development); hyper competition on the world market and high rate of renovating product ranges, individualization of products, where the marketing and service functions make the greatest contribution to forming the new cost and value; high level of system consistency and information volumes exponential growth, which is required for analysis and taking practical managerial solutions; system transformations, sophistication of business environment and processes in terms of technical improvement of production, labor organization and management.

These factors are interrelated and significantly influence the strategic guidelines of TS business entities. Under such conditions the managers find out that their fundamental theories become inefficient, traditional models making it possible to forecast and administer business need replacement with more organic understanding and non-linear thinking. The studies of endogenetic objective laws, sensitive areas, influence of structural dynamics on TS development trend get updated. Many managers boast synergic thinking and consider TS as a living system capable of self-development and self-organization. Such understanding comes sooner or later to all investigators of complex systems, whatever field of knowledge they are involved in. Haken (2003) emphasizes that time has come for synergic background [11].

ICC (investment and construction complex) management system shall be aimed at shaping synergic potential providing sensitivity and

adequate response of TS components to synchronous, multi-positional managerial impacts for the development according to a consolidated vector of target system. It is important to bear in mind that the development rate dynamics intensifies as far as it moves from global to local – the lower is the facility scope and narrower is the sphere of activity under consideration; the more significant are the fluctuations in the rates of innovative development the-reof. The accelerating innovative development brings about an adequate growth of synergic potential, which comes forward as a basis of modernization process [12–17].

The management system of balanced innovative development is aimed at attaining TS self-regulation and self-organization. It is expected that a decisive role is allocated to the state, which is destined to create favorable environment for innovative development: institutional conditions, i. e. it establishes standards and rules contributing to either a rise or a paralysis and a decline in the synergistic potential of the system. The state comes out with respect to TS as the subject of management, it determines the goals and objectives of development and is destined to provide reaching and settling thereof. In this role it determines directions, rates, organization-and-economic and financial support of innovative development in a decisive degree. The entirety of conditions of the latter one is provided, on the one hand, by profound historical, cultural, technological and managerial experience, on the other hand, by the efficiently acting state emancipating the creative potential of TS to a maximum extent.

Considering the fact that the intellectual environment is the main source of innovations, the influence on TS entities is possible by means of entering negative entropy into a system (instruments are used) and implementing the balanced development principles. Its peculiarity consists in maximum regard of immanent TS properties, which is revealed in the process of environment monitoring; structure and level of heterogeneity for implementing reflexive control; degree of influence of control parameters on the order parameters, which is revealed in case of approximating values thereof in dynamics in the process of economical and mathematic simulation for shaping synergic system potential. It is necessary for increasing the level of TS activity, attaining bifurcation state

with the aim of regulating PSS development and attaining synergic effects [18–23].

The efficient control systems get shaped with due account of peculiarities of the country and territory, state of national economy, particular goals and objectives being solved in definite periods of time, capabilities of resources' provision and departmental specific features. In this connection a detail understanding of general regularities and particularities of development of TS and its bodies is of great importance. The control system structure shall include basic components and subsystems interacting with each other: organizational, informational, production and intellectual. They are sensitive to perception of manufactured products by the end consumers, whose reaction is taken into account in the system in accordance with its contents. A decision about transformation is shaped in control system on the basis of combination of characteristics of TS state and processes running therein.

It is reasonable to build specialized devices and subsystems as part of control system providing real-time monitoring of state of running processes, analysis thereof and revealing prerequisites of innovative development.

The “Information” subsystem provides for acquisition and regulation of primary data on TS, ranging, assessing its significance, profitability and sphere of application. This subsystem is a basic technological platform providing all other functions and processes with the required data. The “Organization” subsystem reflects the structure of TS elements interaction both with respect to composition, and capacity arranged in the form of structure-forming links and documents. Its technological basis is formed by the network information technologies, without using these technologies the modern management processes are inefficient. The “Intellect” subsystem corresponds to a combination of elements of knowledge of engineering computer environment (artificial intellect) and personnel professional knowledge and experience. This subsystem based on its intellectual properties is decisive in the fields of: innovative solutions, quality of management processes, revealing symptoms of fluctuations, bifurcations and other synergic effects. Since a decisive role in all subsystems belongs to information technologies, the self-organization processes more often than

not are the tasks of informational management. All subsystems are inextricably linked with each other and can not be adjusted and formed autonomously: every variant of one of the subsystems most efficiently corresponds to definite versions of the other ones; a change in one subsystem demands readjustment of the other ones, otherwise the TS management system would be ineffective. It is necessary to take into account the interrelations between subsystems and character of interdependence thereof to the full extent in case of formulating self-organization tasks. The modification of state of any element disturbs adjustments of all the system and demands a managerial impact aimed at shaping a new harmonic coordination (conjunction) of elements. The value of quantitative transformations of elements (subsystems) of the system and links between them under condition of harmonic conjunction thereof can become a prerequisite of a synergic effect. If the dynamics takes place towards worsening quality and exceeds certain permissible threshold, the system properties change fundamentally, the former settings do not already solve the problem, and it is necessary to take a decision about changing composition, structure and organization of components of the management system ICC [2, 24–28].

The balanced TS management changes the character of management: from enforcing an object of management to a new state to establishing favorable conditions for attaining natural target order thereby. The methodology of TS balanced innovative development consists in coordination of specific principles, approaches, regularities, tools and properties. It is important to take into account that disproportions are able to destroy the system: in case of extreme non-linearity stiff resonance breaks the system, whilst an unlimited openness dissolves it in the environment. It is important to take into account the law of entropic equilibrium; in case of mitigation of non-linearity a feedback becomes weaker, while its excessive closeness brings about a growth of entropy.

The efforts are to be directed not only to system management, but to establishing conditions, when it would get out to innovative trend. It is consistent that the problems of where to start and what shall be the primary modernization steps always appear to be in the focus of attention in the course of discussing any modernization project.

In case of absence of clearly defined algorithm of attaining synergic effects many investigators offer a trial-and-error method based on extrapolation of trends, forecasting, experience and synergic thinking of a manager imparting the well-disposed goals to the organization. Therefore, a process of apprehension of strategic goals and objectives for TS striving for self-organization, stability and innovativeness is the basic one.

The short-time advantages (e. g., prosperity and high profits from production activity) can bring about in the longer term the aggravation of functioning of suchlike systems. The global problems of climatic changes, depletion of oil resources, exponential growth of population, degradation of agricultural lands, deficit of potable water are generally known and the consequences thereof have already manifested or will manifest themselves within a couple of decades to come. “A burden on the part of a man on the environment continues to grow despite the development of technologies and efforts of public organizations. The mankind has already left the boundaries and is now within uncertainty area. However, the understanding of this problem is poor in the world. In order to decrease impact on the environment and return to a permissible level, it is necessary to change the personal and public values, which will require quite a lot of time” [29–30].

## Results and discussion

According to a concept of sustainable development the main problem consists in providing a balanced state of TS development with an imperative of precluding a disaster and society orientation to self-maintenance, which requires quite different models and approaches to management. The technical progress, innovations, formation of competitiveness, marketing management and market adaptability are necessary, but are insufficient, since the development trend is a result of non-linear interactions.

The methodological provisions of ICC balanced management system consist in the following:

- heterogeneous structure encompassing dissimilar elements: technology, organization, ecology, state of mind, psychology, politics, security as well as all types of resources and links between them;

- commitment to a positive synergic effect through principles and effects on managerial TS parameters with an imperative of analyzing a phase field and revealing the immanently inherent ways of development (attractors);

- unique architecture owing to absence of standard algorithm and commitment to a creative approach with a set of elements for development: investment, intellectual, technological, foodstuff resources forming a synergic potential;

- a task of managerial structures is to simulate and forecast the development trends shaping positive feedbacks, create prerequisites of TS transition to a new quality meeting requirements and image of the “future”;

- a path of TS development can be assigned by the systems of differential equations with the aim of predicting and scientific substantiation of programs being developed, since they have to be realistic and feasible.

The conservative approaches not taking into consideration the natural ways of evolution (attractors) immanently inherent to the managed system are inefficient from the positions of a concept of balanced innovative TS development. Ayurov pointed out that it is irrational to impersonally control the dissipative systems, since the controlling actions in case of imposing functioning modes to dissipative system not inherent for it bring nothing but harm thereto and get always rejected.

A concept of balanced innovative development of TS is committed, first of all, to the system internal self-organization, to something immanently inherent thereto, to intrinsic laws of evolution, which are to be identified and improved in the required direction. According to this approach one should not impose the ways of development to elaborate systems – first of all, it is necessary to understand their own trends (natural attractors), and then bring them to a path of evolutionary formation thereof using resonance topologically adjusted impacts.

An important factor of TS self-organization is a national idea expressing a symbolic capital of culture in the information space. The activation of innovative development of TS and economy of Russia is possible under conditions of coordinated management due to positive synergic effects in the systems targeted to a large-scale innovative breakthrough and mastering capabilities of the new

technological mode. The main difficulty consists in how to manage “without management”, how to push TS by means of insignificant resonance impact to one of the intrinsic and favorable for it ways of development, how to provide the self-controlled and self-sustainable development. The implementation of principles, approaches, tools and mechanism of a system of balanced TS development will help comprehensively implement the existing system potential and reckon on the positive synergic effect.

The strategic task consists not in replacing the concept and model, but in maximum efficient harmonic use of raw-material and innovative development factors available in ICC and in the country. It is necessary to change emphases, but not the models. The advances to an adopted social pattern shall be not only of a stepwise, but of a synchronous character, i. e. it should be parallel-serial. Particularly such a methodological approach shall be laid as a basis of the strategy of TS transition to innovative development path. It is determined, first of all, by interrelations and interdependence of public phenomena, secondly, by the necessity of keeping record of the system inertness, i. e. time when the intended state is attained.

## CONCLUSIONS

1. The management system of balanced innovative development corresponds to a concept, methodological aspects and mechanism of balanced innovative development for increasing efficiency of managerial impacts, providing integrity, homeostatic balance and synergic potential. The system shall include the main subsystems interacting with each other: organizational, informational, production and intellectual.

2. In order to increase the organized nature, controllability and predictability of TS, it is necessary to understand the principles of balanced innovative development, which proceed from peculiarities of the system being investigated, control rules, stable and investment-innovative development.

3. Dynamics of the path of TS development is determined by three key factors: existing limits, permanent drive to a growth and lagging between approaching the limit and hysteresis. The structural component of development is exposed to an impact of economic waves of different duration, but this influence, as practice shows, is interdependent.

4. It is advisable to direct administrative activity to the struggle against entropy for progressive TS development so that the rate of its reduction in TS is higher than the rate of growth in the national economy, introducing and incrementing the level of negative entropy (information, knowledge and innovations, public morals, corporate culture) forming the intangible assets. Otherwise, it will be necessary to permanently increase a degree of TS openness.

5. The generalized order parameters are important for TS, which are expressed in: a) coherence of values reflecting availability of vector of entities movement in heterogeneous environment; b) informational interaction reflecting an ability of entities to borrow, use and generate new information on the basis of available knowledge; c) concentration of multiplicity of entities characterizing availability of dissimilar structures in the system and imminence of interaction thereof; d) concentration of resemblance of entities demonstrating availability of a chance of interchangeability thereof.

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